Exhibit B

UNITED STATES DISTRICT COURT
EASTERN DISTRICT OF NORTH CAROLINA
SOUTHERN DIVISION
7:13-CV-00021-BO

C O P Y

AMEC ENVIRONMENT & INFRASTRUCTURE, INC. f/k/a AMEC EARTH & ENVIRONMENTAL, INC.,

Plaintiff,

vs.

STRUCTURAL ASSOCIATES, INC., and TALON INDUSTRIES, INC.,

Defendants.

D E P O S I T I O N

JEFFREY ALAN PFAENDTNER

One West Fourth Street
Winston-Salem, North Carolina

Wednesday, April 30, 2014
10:08 o'clock a.m.

Atlantic Professional Reporters
Winston-Salem, NC 27116-1672

NOTES

Page:Line	Subject Matter	Relates To	Action

APPEARANCES OF COUNSEL

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OTHER APPEARANCES

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EXHIBITS

STIPULATIONS

Pursuant to notice and/or consent of the parties, the deposition hereon captioned was conducted at the time and location indicated before Connie B. Meeker, Notary Public in and for the County of Guilford, State of North Carolina at Large.

The deposition was conducted for use in accordance with and pursuant to the applicable rules or by order of any court of competent jurisdiction.

Reading and signing of the testimony was requested prior to the filing of same for use as permitted by applicable rule(s).

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The witness, JEFFREY ALAN PFAENDTNER, being first duly sworn to state the truth, the whole truth and nothing but the truth, testified as follows:

(10:08 o'clock a.m.)

EXAMINATION

BY MS. GAVALIER:

Q. Good morning, Mr. Pfaendtner.

A. Good morning.

Q. We just met off the record. My name is Kristi Gavalier, and I'm here on behalf of Amec and Zurich. I appreciate you being here today.

Have you ever been deposed before?

A. Yes.

Q. Okay, how many times?

A. I think this about my tenth time.

Q. Okay, so I imagine that you are familiar with the general procedures, but just to make sure that everything goes as well as it can today, I'll just hit a few items.

As you know, we're being recorded. And so in order to have a clean transcript, if we can do our best not talk over one another ---

A. --- Okay.

Q. --- That will be helpful to the court reporter.

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Also if you can answer in the affirmative like you just did, indicating okay as opposed to using phrases or terms we may use in casual conversation.

A. Okay.

Q. If you need a break at any time just let me know. I just ask that if there's a question pending you go ahead and answer that question.

A. Okay.

Q. And if I ask a question that you do not understand or would like clarification, please let me know and I'm happy to try to provide that to you.

A. Sounds good.

Q. Okay. And, Mr. Pfaendtner, will you state your full name for the record, please.

A. It's Jeffrey Alan Pfaendtner.

Q. And will you state your date of birth, please.

A. February 28th, 1967.

Q. And will you state your business address, please.

A. 2355 Polaris Lane North in Plymouth, Minnesota.

(* Exhibit 1 was marked *)

Q. Mr. Pfaendtner, I'm going to show you

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what's been marked as Exhibit 1. This is your notice of deposition.

Have you seen this document before?

A. I saw it in my client's office yesterday, but I -- I don't have a copy of it.

Q. Are you here testifying pursuant to that notice of deposition today?

A. Yes.

Q. Okay, you can set that aside.

Mr. Pfaendtner, what did you do to prepare for your deposition today?

A. I reviewed my file.

Q. Okay, and you gave me a copy of your file right before your deposition began. Correct?

A. I did, on a flash drive.

Q. And I will hopefully have an opportunity today to glance through that file to see what it contains, but can you give me generally the items that you have in your file that you reviewed yesterday?

A. Well, primarily it contains discovery documents that I received from my clients' depositions, reports, photographs.

It contains a few items that I found on my own, just some research items on the subject

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fiberglass pipe, and that's pretty much it.

Q. Okay, you mentioned reports.

Do you have a copy of Sullivan Curran's report?

A. I do. Should I pull it out?

Q. No, sir.

Do you have a copy of Mr. Wenzel and Dr. Manning's report?

A. I do.

Q. Any other reports that are in your file that you're aware of?

A. There's one from -- I believe they're called MDA in Pennsylvania. They were initially involved. And they did a -- I guess the initial inspection -- on the subject fiberglass pipe.

Q. And MDE ---

A. --- MDE?

Q. --- Is that familiar?

A. Yeah, MDE. I'm sorry. Let me just verify.

(Witness examined documents)

A. MDE. Correct.

Q. And MDE was retained by the Navy. Correct?

A. I believe so.

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Q. Okay, and MDE did destructive testing of the damaged pipe. Correct?
A. They did.
Q. Were you present for some of that destructive testing?
A. I was not.
Q. Were you present at MDE's facilities after they did some destructive testing?
A. I was. I -- I visited them after the -- their destructive testing and did a visual inspection of the subject pipe.
Q. And what did you learn during your visual inspection of the damaged pipe?
A. It wasn't so much learning but documenting the -- the features of the pipe.
I took many photographs. I made some measurements of the thickness of the pipe, asked a few questions. But mainly it was just characterizing and documenting the pipe.
But I -- I didn't walk away from that inspection with -- with any conclusions at that point.
Q. Okay, so it sounds like you were just obtaining some general information about the pipe. Is that fair?

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A. That's correct.
Q. You also mentioned depositions.
Have you read the deposition of Bryan Yosay?
A. I have not.
Q. Have you read the deposition of Gabe Gallegos?
A. I have not.
Q. Okay, read the deposition of Mr. Curran?
A. I have not.
Q. Okay, read the deposition of Dr. Manning?
A. I have.
Q. Have you read Clyde Williamson's deposition?
A. I have not.
Q. Paul McIntyre?
A. No.
Q. Okay, so it sounds like the only transcripts that you've read have been Mr. Curran and Mr. -- or Dr. Manning. Is that correct?
A. That's correct.
Q. Okay, Mr. Pfaendtner, you also mentioned photographs.
MR. REICH: Can we go off the record for a second?a

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MS. GAVALIER: Yes.
(Brief recess)
Q. Okay. Mr. Pfaendtner, you also mentioned photographs.
A. Yes.
Q. Have you taken photographs of the damaged pipe yourself?
A. Yes.
Q. And have -- are those photographs all on the drive that you gave us this morning?
A. Yes, they are.
Q. Mr. Pfaendtner, have you performed any calculations?
A. The calculations were -- any calculations performed were done by my -- my colleagues at Crane Engineering, namely -- primarily Chris Brand who's a mechanical engineer -- at my request.
Q. Okay, and are his calculations included in your file materials you gave us this morning?
A. His -- his calculations are in form of a finite element analysis, so it's not a very portable -- I -- I -- I suppose -- it -- I -- it could be transported to you electronically. But it's not contained on that flash drive. But it's certainly producible.

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Q. Okay. And I'll ask you ---
A. --- Okay.
Q. --- Some more questions about that later.
Mr. Pfaendtner, you had mentioned that you had been deposed about 10 times before. Is that correct?
A. Yes. This is, I believe, the tenth deposition.
Q. Okay, and have the depositions that you've participated in all been in conjunction with providing litigation services?
A. Yes.
Q. Okay. I'm going to hand you what we'll mark as Exhibit 2.
(* Exhibit 2 was marked *)
Q. And that should look familiar to you.
Mr. Pfaendtner, is that a copy of your curriculum vitae?
A. It is, but it's -- doesn't appear to be the most current version.
Q. Do you have a current version that you can provide to us?
A. Yes. I -- I have it on my computer. And it may -- I can check -- but it might be on that thumb drive. But I -- I think essentially the only

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changes are in -- in my title.
Q. Okay. Well, we'll work our way through and you can ---
A. --- Okay.
Q. --- Provide me the updates as we go.
Mr. Pfaendtner, you are a licensed professional engineer. Correct?
A. Yes.
Q. Are you licensed in North Carolina?
A. I am not.
Q. Have you ever done any work in North Carolina?
A. I have not, no.
Q. Which states are you licensed in?
A. In Ohio and Minnesota.
Q. Is your license in Ohio active?
A. It is.
Q. And is your license in Minnesota active?
A. Yes.
Q. Have you ever had any disciplinary action taken against you by any of the states in which you are licensed?
A. No.
Q. Have you ever had any complaints filed against you in any of the states in which you are

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licensed?
A. No.
Q. Do you hold any other professional licenses?
A. No. Other than my -- my degrees, no.
Q. Okay, and you have a bachelor of science in material science and engineering. Correct?
A. Yes.
Q. Okay, and then a PhD in material science and engineering. Correct?
A. Yes.
Q. Mr. Pfaendtner, in order to maintain your engineering licenses in Ohio and Minnesota, do you have to take continuing education courses?
A. I need -- for both space I need continuing education credits. But -- and they can take form of courses or presentations, papers published, things like that.
Q. Okay, so if I understand you correctly, you can either take a course or you can participate in a presentation or published work also counts toward credit.
A. Right. That's correct. And I -- I believe most of my recent credits have been from me giving presentations.

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Q. Okay. Now, it looks like your CV does not contain a list of presentations.
Do you have a list of those anywhere?
A. I have it electronically. I -- I -- I have a spreadsheet that -- on which I track my -- my credits for my licensure.
Q. Okay, would you be willing to provide us a copy of the presentations that you've done in the past five or so years?
A. Sure, sure. Although I -- some of them are proprietary, some of them are giving -- given confidentially to our industrial clients. So I -- I think I can generically state that without giving away the client's name.
Q. Thinking back on the presentations that you've done in the past five or so years, have any of them dealt specifically with fiberglass pipes?
A. No.
Q. Okay. Again, given the same timeframe, have any of your presentations involved fuel releases?
A. Yes.
Q. And can you explain that to me a little.
A. The -- one of Crane Engineering's main areas of expertise is fuel related instances of --

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especially propane gas, natural gas incidents, whether it's explosion, a fire, a carbon monoxide poisoning.
So we -- we've done many, many investigations related to -- to those types of incidents.
Q. I believe you said fuel related incidents. Correct?
A. Yes.
Q. And is there a -- are those fuel related incidents all the result of similar causes or different causes?
A. It's -- it's -- it's a whole host of causes.
Q. Okay.
A. It's never the same. But in the end, it -- it -- I -- I would say many times, though, they come down to a material failure, though, of -- of some kind, whether it's metallic or a composite failure of -- of one kind or another.
Q. Any that you recall that -- where the cause was a broken or damaged pipe?
A. Several involved damaged pipes and fittings of both metallic and composite.
Q. And am I correct in thinking that a

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fiberglass pipe would be considered a composite pipe?
A. Yes.
Q. Okay, Mr. Pfaendtner, are there any continuing education credits that you've taken recently where the course has involved fiberglass pipes?
A. No.
Q. Any continuing education courses that you've attended recently that involve fuel releases?
A. Yes. I've -- I've presented on -- on fuel releases -- or at least the -- the material failure portion of -- of fuel releases.
Q. Okay, any courses that you've taken to obtain credits that involved ---
A. --- No, I -- I usually teach the courses.
Q. Right. Your CV contains a list of publications, and it looks like the last publication was in 2004. Is that correct?
A. Yes.
Q. And have you had any publications since 2004?
A. None in peer review journals such as -- such as these. These -- these publications on my CV are mainly done as part of my graduate school work, which is -- publications is essentially a requirement

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of -- of doing graduate school work, so....
Q. So anything that has been published since 2004, what kind of -- strike that.
Have you been published in like trade magazines or news letters, things of that nature since 2004?
A. On -- on rare occasion I might have two or three publications out there in trade journals, things like that, but not -- not peer reviewed.
Q. Okay.
A. Although, I -- I'm currently working on a paper to be published in the peer review journal.
Q. What's the subject of your current paper?
A. It has to do with failure of -- of brass that results in -- in fuel releases or -- and -- and water releases. In particular, we see this a lot in -- in water damaged homes. So it -- it has to do with improper composition of the brass and -- and environmental interactions with that improper composition that causes it to fail prematurely.
Q. So you said that most of your publications listed here were produced as a result of your graduate work. Correct?
A. Yes, with the exception of the last one that was published while I was at General Electric.

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Q. Okay, and what was the subject matter of that last one?
A. Part of my work at General Electric Aviation -- the -- the business was designing and manufacturing jet engines, commercial and military jet engines.
I worked in our research and development group developing coatings for the high temperature section of the engine -- the -- the -- the turbine.
And in particular, my work involved developing coatings, high temperature coatings, for the turbine. And these are coatings that -- that operate in excess of 2,000 degrees Fahrenheit, so -- so that paper has to deal with the durability of these composite coatings.
Q. When I was glancing through the list of the other publications, I noticed two words seem to come up frequently, and one was alloys.
I believe we've already ---
A. --- Yes.
Q. --- Mentioned alloys this morning. If you can just give me a general idea of what an alloy is.
A. An alloy is -- generally it refers to metallic materials. And an alloy is essentially a mixture of two or more metal elements together, so --

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for instance, brass is a combination of copper and zinc. Steel is usually a combination of primarily iron with -- with carbon and manganese and other -- other additions depending on -- on what the function of the steel is in -- in application.
Q. The other term that I saw come up frequently was embrittlement.
Can you explain embrittlement to me?
A. Sure. Embrittlement is -- it -- it's an effect of chemical composition usually involving impurities.
So say we were -- we were talking about brass. Brass is susceptible to, I guess, a type of embrittlement by ammonia. And -- and so that's actually the subject of the paper I'm working on. Ammonia can cause brass to crack.
Stainless steels can be cracked by chlorine in the environment. Steels can be cracked by things like phosphorus and sulfur.
So embrittlement generally refers to the failure of -- of alloys under influence of these impurities. And the impurities can come from the -- the environment such as ammonia or -- or -- or chlorides from -- from -- from the sea, or they can be internal impurities such as sulfur and phosphorus

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and arsenic, things like that, that get into the steels. And then are -- so they're -- they're present from the very beginning from the manufacturer of the alloy. And then they -- they rear their heads sort of later on when the part is in use.

Q. Would you say that what you've just described to me has been a focus of your research -- or was the focus of your research when you were a graduate student?

A. The -- the embrittlement, in -- in particular, a -- a type of embrittlement called dynamic embrittlement was the focus of my PhD work. But -- but it -- it falls under the general heading of -- of -- of failure analysis of materials.

Q. Does embrittlement only occur with an alloy?

A. No. It -- the -- the phenomenon of environmental interaction occurs across, essentially, all materials. But it's -- it's -- it's -- it -- it takes on a different name depending on the material.

So plastics are susceptible to environmental interactions. And it's -- one of them is called environmental stress cracking, which is -- is a form of embrittlement.

So we see that in -- in sprinkler systems

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where you have plastic pipe and plastic fittings. So -- so we can talk about embrittlement in -- in just about every material class. But it takes on a different name usually.

Q. Since the subject pipe here is a fiberglass pipe, is there a type of embrittlement that can affect a fiberglass pipe?

A. In a sense, yes. Every -- pretty much every material has -- has its vulnerabilities, and so if you go to, say, the Amron website and you look at -- or any fiberglass pipe manufacturer's website, it will -- generally will give you a list or a -- a matrix of, use this pipe for this environment. So you know, it might be used for fuel gas or used for conveying compressed gas or natural gas.

So generally pipes are constructed to take into account the environments that they're going to encounter both the -- the material it's going to convey.

So JP-5 jet fuel or -- and as well as the -- the environment surrounding it -- soil -- whether it's, you know, acetic soil or -- or -- or whatever. So -- so generally you -- you want to select materials based on -- on the -- the operating environment.

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Q. Did you do any research on fiberglass pipes when you were a graduate student?

A. No. My -- my primary -- although, I -- I had graduate -- or engineering classes at -- when I was an undergrad and graduate student involving composites. And so we -- we studied it from an engineering standpoint.

And then my practical experience with composites happened at General Electric. So I -- I was a member of -- during my nine years at GE I was a -- a few of those years I was in the composites technology group. So we didn't -- we didn't produce pipe, but we produced composite fan blades such as on a commercial jet engine.

When you look inside the -- the opening of the -- of the jet engine, you'll see a -- a fan. Well, some of those fan blades are made of composites, mostly made of carbon fiber not glass fiber like the -- the subject pipe.

So -- but -- but it -- the -- the -- the technologies are very similar. You have fibers, whether it's a glass fiber such as the pipe, or a carbon fiber in a -- in a -- in a polymeric resin, so -- so a plastic -- so a fiber mixed with a plastic that make up these -- these structures.

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Q. Okay, let's actually take a look at your employment history.

You are presently with Crane Engineering. Correct?

A. Yes.

Q. And what is your title or position at Crane Engineering?

A. Well, it -- it's -- it's been evolving. Until very recently I was chief technical officer and principal engineer.

But we've, just in the last couple of weeks, are -- have gone through a reorganization, so my title now is just simply principal engineer.

Q. And you started at Crane Engineering in 2007. Correct?

A. Yes.

Q. Did you start as the chief technical officer at that time?

A. I'm not sure or I don't recall what my title was. But it was, I think, just consulting engineer.

Q. Okay, as a consulting engineer, what did your duties include?

A. When I initially started, those duties just simply included being an individual contributor,

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primarily working on our industrial consultation side of the business, which is basically non-litigation related work.

So for instance, we -- we do a lot of consulting for medical device manufacturers in the twin cities area. So a lot of small companies, some of them startups, will come to us for specific engineering expertise that they don't have in-house. So we'll -- we'll offer that to consultation and materials evaluation, testing, things like that.

And then the smaller fraction was litigation related, sub -- subrogation primarily.

Q. In the industrial consultation services that you provide, is it a wide range of engineering services or do you tend to focus on a specific field of engineering?

A. No. No, it -- it's very broad. And -- and my -- my background is -- is very broad in materials.

I worked on metallic alloys from medical devices to large industrial structures. We worked on architectural glass.

We've consulted with manufacturers of -- of -- of cookware that use -- that you might use in your kitchen, on the mechanical properties of

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cookware, things like that.

So really anything materials, we've -- we've investigated -- to, you know, the -- the facade on -- on -- on a high-rise building that is -- has some kind of staining or something. We'll -- we'll get in and look at the -- what caused it, whether it's -- it's, you know, air pollution or -- or -- or whatever. So really, any -- anything materials related we will do, including plastics.

Q. Would you say that the same scope of your services applies to the litigation services that you'll provide?

A. Yes.

Q. You had said that, to the best of your recollection, you had started at Crane Engineering as a consulting engineer. Correct?

A. I don't know if that was my exact title but it was as an individual contributor working with clients.

Q. Okay. Did it evolve at some point in time?

A. Yes. And it was -- it was almost a continuous evolving.

Crane Engineering's a small company, so there are few boundaries, so you kind of progress,

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you know, by your -- sort of your -- your interests and then your talent.

One of the first larger responsibilities I took on was, essentially, ownership of the industrial consulting part. So I -- I oversaw the team that did, primarily, the -- the industrial consulting. So I was a -- the -- I guess, the team leader.

Q. Okay, and after you were the team leader of the consulting -- excuse me -- the industrial consulting portion of Crane Engineering, was there another step or progression after that?

A. Yes. The next step was to vice president, so I was one of three vice presidents. And with this recent reorganization, the vice president title is -- is gone away and replaced by something else.

And then after vice president I -- I essentially accumulated titles. So I was vice president and then chief technical officer and then I also got the title of principal engineer. So I -- I -- I guess for a while I was carrying those three titles.

Q. Okay, and as chief technical officer, vice president, and principal engineer, what were your duties?

A. Still, you know, the primary duty was to

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serve clients. So I was still essentially a -- a team leader or a project leader team leader.

But the scope of my projects became larger and larger and -- and mainly involving multiple disciplines. So I would be project manager for a -- a project that required multiple engineering disciplines.

It also involved the -- mentoring my colleagues on report writing, the scientific method, and -- and generally just be the execution of -- of industrial cases and legal cases from -- from a technical standpoint.

Q. In your current position, or positions, about how much of your time is divided between the industrial consultation services and the litigation services?

A. It's on the order of -- of 80 percent legal and 20 percent industrial consultation. And so the -- the industrial consultation I do now is -- is primarily larger projects and -- and -- and not so much the -- the -- the small projects that -- that take a day to execute.

Q. Prior to working at Crane Engineering you were at GE Aviation. Correct?

A. Yes.

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Q. Okay, and it looks like you started there in 1998. Does that sound right?
A. Yes.
Q. And it looks like you started as a lead engineer. Is that right?
A. Yes.
Q. Okay, and what were you responsible for as a lead engineer?
A. Again, I was -- I was essentially an individual contributor working several engine programs that were sub-sections of larger programs.
So if -- if you imagine a jet engine that has many components, and so it -- it's -- it's divided up.
You can imagine the tree of -- of -- of projects and -- and -- and management layers. And it takes 10 to 20 years to develop an engine. So -- so it -- it -- it -- it gets all divided down across a thousand people or more.
So my -- my duties were mainly developing new coatings for -- for the turbine section. So I had a -- a small team of -- of engineers with whom I worked. But I -- I wasn't in charge of anyone.
Q. And developing those new coatings that you talked about earlier, was that the main focus of your

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work from 1998 to 2002 as a lead engineer?
A. Yes. Yes.
Q. Okay. And then it looks like in 2002 you became a staff engineer. Correct?
A. Yes.
Q. And did your duties change as a staff engineer?
A. No. And -- and that's a distinction I never really understood. I think it was more of a -- an administrative distinction. It was essentially the same duties.
Q. So it's fair to say that you had the same responsibilities as a staff engineer that you had as a lead engineer.
A. Right. And -- and I think it might just be a reflection of more -- more experience, more seniority in -- in the -- in the department. But it -- I -- I still was an individual contributor. But also, I -- I -- I switched departments at that point as well, so....
A. Did the focus of your work change?
A. Yes, yes.
Q. And what was your focus when you changed departments?
A. Well, as I mentioned earlier, I moved to

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the composites technology department, which was essentially a -- a -- actually it's a -- a section within the materials department. So I -- I moved to a different section.
I -- I moved from a group focused on high temperature materials, high temperature alloys, for the -- the turbine to a -- a group that had a -- a focus on lower temperature materials such as the fan blades and -- and things like that.
I also -- but my -- my primary focus during that time was classified, so I had a -- a government security clearance. So it was classified work that I was doing.
Q. And then prior to your work with GE Aviation you were a research fellow at the University of Pennsylvania. Correct?
A. That's correct.
Q. Okay.
A. And research fellow is essentially my PhD work.
Q. And we talked about that a little bit with regard to your publications.
Is there any other work that you did as a research fellow that we didn't touch on earlier this morning?

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A. I -- I did a small amount of consultation with my advisor, you know, litigation related things. But -- but not that much.
Q. So ---
A. --- But with my main research, there were many peripheral activities such as designing and constructing of -- of testing equipment, doing characterization of materials, so using microscopes and -- and essentially probing the -- the chemical composition of materials, probing the mechanical properties of materials, strength and durability, things like that. So it was kind of a -- a broad endeavor, but focused on solving one specific problem.
Q. Did any of those peripheral activities that you just referenced -- and I know that's a somewhat vague term -- but did any of those peripheral activities involve fiberglass materials?
A. No. My -- my graduate studies essentially involved advanced materials. Composite fiberglass is -- is a -- it's a well established material. And then so my -- my work was on more cutting-edge things.
Q. To your knowledge, has there been any advances in fiberglass materials in recent history?

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A. Well, certainly there have been advances in composites, namely, the replacement of fiberglass, which is a silicon oxide material. It -- it's an oxide.

The replacement of those fibers with -- with other fibers such as various forms of carbon, graphite, things like -- you've heard of Kevlar, which are -- these are all fibers that can be introduced or -- or held together with a resin, you know, an epoxy-like material to form shapes.

So -- so the advancement isn't so much in the advancement of, say, the chemistry of the glass fiber. It's just get rid of glass fiber and use other more capable materials.

Q. Was fiberglass a common material to be used in the early 1980's?

A. The -- I don't -- I'm -- I don't know about the evolution of that industry. But certainly, you know, we've all been in a fiberglass boat or a canoe or something like that.

So I'm not sure when fiberglass was -- was introduced, but certainly it's been around for -- for many decades. And it's still used today. You know, if you have a -- a -- a composite shower stall, a lot of those are -- are a fiberglass composite that are

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-- it's fiberglass that's sprayed on.

Q. Uh-huh. But it sounds like from what you said earlier, perhaps there are materials that are replacing fiberglass now. Is that fair?

A. Well, as -- as a need arises. You know, I mentioned the -- the -- a fan blade on a jet engine. You know, fiberglass isn't capable of -- of operating in a jet engine.

So you need more -- more capable materials, whether that means stronger, tougher, more resistant to heat, things like that. So -- so fiberglass is -- is a -- it -- it -- it's -- it's essentially a commodity material. But still has -- obviously has its uses in -- in -- in industry.

Q. Mr. Pfaendtner, have you been involved in any projects that related to locating, excavating, or replacing a pipeline?

A. Well, every project is unique. But certainly I've been involved in -- in pipelines of -- of various sorts.

Fiberglass -- I was involved in a fuel release at a gas station in Texas whereby a fiberglass line broke and there was environmental damage.

But -- but primarily it's -- it's -- it's

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failure of pipelines and pressure vessels that either hold a gas that -- that rupture and cause property damage or -- or injury or death.

Q. The gas station in Texas, in what capacity were you involved in that incident?

A. It -- it was similar to this -- in -- in this matter here.

I -- I received the -- the fiberglass pipe artifacts, did -- did inspections, destructive inspections, microscopic work, chemical analysis, things like that to -- to -- to essentially understand the failure and how the failure came about.

Q. And what was the cause of the failure of the fiberglass pipe at the gas station in Texas?

A. It -- it was essentially installation related. It was a -- the -- the installer had -- had applied too much torque -- or not too much torque but he was applying a fitting to the fiberglass pipe.

He did not take care to use a -- a backing wrench so that he didn't transmit his -- the torque of applying this fitting into the system. So he -- he -- he tightened down this -- this fitting, and the -- the -- the force of that was transmitted into the system. And it reached a weak point and it caused

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failure. It caused a -- an underground failure that -- that wasn't visible.

Q. Was that weak point in a length of the pipe or was it a -- at a joint?

A. It was at a joint.

Q. Do you recall, generally, when it was that you were involved at that -- in that project?

A. About three years ago.

Q. Okay. Any other projects that come to mind that are similar to what we're dealing with in this case today?

A. Well -- well, they're all similar. Maybe not the technology of a fiberglass pipe, but generally most material fail -- failures involve an understanding of the stresses that -- that caused the failure.

Is there any corrosion mechanism. And -- and I use the term corrosion loosely in that are there environmental interactions that -- that -- that weaken the material over time, things like that.

So I -- I tend to view failures from a fundamental standpoint using fundamental engineering principles of -- of engineering mechanics, and -- and chemistry and metallurgy materials. So what -- what are the fundamentals. And -- and -- and so I -- I

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use this engineering toolbox and apply it to -- to the -- the problems in general.
Q. So it sounds like a lot of what you deal with are -- or the projects that you investigate have to deal with material failures.
A. Yes. Or at least that's when I become involved. But -- but Crane Engineering obviously has a -- a larger scope.
Q. And in trying to drill down a little bit, are there other material failures where you have dealt with pipes specifically?
A. I would say the -- the majority of my cases involve pipes and pipe fittings.
Q. Okay, any specifically that have to deal with fiberglass pipes?
A. Primarily, they're -- they're metallic, they're steel pipes, copper pipes, brass pipes. I -- I can't give you the number involving composites or fiberglass but it's -- it's a handful.
Q. Okay. This may help us a little bit. If you'll turn in your CV to -- I believe it's the third page. You've got a list of your testimony in the past four years.
Does that list look up-to-date to you or are there other cases that you've provided testimony

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in?
(Witness examined document)
A. I think there are two that are missing this year.
Q. So two additional cases from 2014?
A. I -- I believe so. I -- I had a -- my -- I -- I have it electronically. I -- I believe so.
Q. And if we could just get an updated copy of your ---
A. --- Sure.
Q. --- Testimony that would be great. Since it looks like we have a manageable list in front of us ---
A. --- Uh-huh.
Q. --- I would like to just touch on each one very quickly and have you give me a general overview of the issue that was involved.
A. Okay.
Q. Okay, so let's just go ahead and start with the first one that's -- it looks like your deposition date was January 8th of 2014.
What was at issue in that case?
A. That was a hog barn fire in Iowa involving a -- a lightening -- I'm sorry -- not a lightening strike but snow load -- heavy snow load collapsed the

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roof. But there were few witnesses so -- that work involved, mainly a forensic analysis of the evidence to understand the sequence of events.
And -- and so in that case, my involvement was -- primarily dealt with a -- a -- a gas pipe that conveyed propane gas and -- and the effects of heat on that pipe. And -- and so I was able to use my analysis to -- to -- to add detail to the time line, the sequence of events, which became important to the case.
Q. Was the analysis done in part to determine the cause of the fire?
A. Yes.
Q. Okay, and what did you determine the cause of the fire was?
A. Well, I determined the cause of the fire was -- was consistent with -- with a -- I'm -- I'm not a structural engineer. There were structural engineers who made the determination that, yes, there was a -- a snow load collapse here.
And so my -- my work -- what I found was essentially the characteristics of the gas pipe was consistent with -- with a -- a -- a collapse in the roof causing a break, causing the fire because you had gas coming out of the pipe. And that -- that

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flame impinged the pipe itself, caused metallurgical changes to the pipe.
So my study was of the metallurgical changes to the pipe and -- and -- and -- and the duration of those metallurgical changes to the pipe.
Q. Okay. So moving on to the second one, it looks like your deposition date was December 6th, 2013.
What was at issue in that case?
A. That was a case in Florida involving a pool heater.
In particular, there was a gas regulator that had internal corrosion and the gas regulator stopped working. The homeowner went to light the pool heater and was burned because of escaping gas.
Q. Okay, moving down to the third row, it looks like the trial date was set for July 29th, 2013.
Did that case go to trial?
A. It did.
Q. Did you testify at trial?
A. I did.
Q. Had you been deposed prior to the trial?
(Witness examined document)
A. No, I -- I don't believe so.

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Q. Can you briefly tell me what was at issue in that case.
A. At issue there was a -- a gas fuel line in a residence. There was a brass fitting that underwent one of these embrittlement phenomena and cracked, allowing gas to -- to be released in a crawl space underneath the residence.
And there was a -- a -- I forget if there was an explosion or just a fire, but the house was destroyed.
Q. Moving down to the fourth row, it looks like your deposition was on May 20th, 2013.
What was at issue in that case?
A. That was a case in the -- in the Bakken Oil Field in North Dakota involving a -- a drilling -- oil drilling derrick for drilling oil wells.
There was a -- a component that fell from the derrick striking the worker and killing him. It -- it involved the failure of a -- of a chain that was holding up this component.
Q. Okay, and did you determine the cause of the chain failure.
A. It was overload.
Q. Okay.
A. So it -- it -- yeah, it was -- it was

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overload of the chain.
Q. And when you say overload, was that -- do you mean that it had worn out or that it was human error in that someone had put too much weight on the chain?
A. I -- I think those things are -- were indeterminate. Obviously I wasn't there during the incident. But it was in the process of moving this several ton oil derrick on to a flat bed truck for -- for transport.
So again, you don't know if it was dropped slightly or -- or what happened, but -- but the -- the chain simply broke by overload, so it -- it experienced stresses in excess of it's strength, so it just failed -- pulled apart.
Q. Okay. All right, moving down to the second-to-last line, it looks like you were deposed on April 18th, 2013, and if you can tell me briefly what that case involved.
A. That was another fire, propane fire, of a -- it was in a trailer park. The trailer owner died as a result of it.
My -- my involvement in that case was -- was fairly focused. It had to do whether or not a -- a gas valve was open or closed at the time of the

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fire.
So it was essentially a -- a forensic analysis, a materials analysis of this brass ball valve to understand what -- what setting it was on. Was it in the open position or closed position at the time of the fire.
Q. Okay. Looking at the last entry on the page, it looks like the trial was the week of September 27th, 2012.
Do you recall if that case went to trial?
A. It did.
Q. Okay, did you testify at trial?
A. Yes.
Q. And what did that case involve?
A. That involved a compressed oxygen gas cylinder. The -- the kind that are used in -- in welding and -- in all sorts of industries. You may have seen them. They're just steel cylinders that have -- whether nitrogen or compressed air or oxygen.
This case involved a oxygen cylinder that -- that burst while it was being filled. The -- the cause of the rupture was in -- internal corrosion to the cylinder. So it -- it killed the operator when it -- it burst.
Q. And it looks like on the next page, the

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second entry actually involves the same case. Is that correct?
A. Yes, that was my deposition.
Q. Okay. All right, the first entry on the second page, it looks like you testified at an arbitration on September 18th, 2012.
A. Yes.
Q. What was at issue in that case?
A. That involved electric motors that are used in, like, slushy machines. If you go to 7-11 there's a -- a slushy machine.
Well, these are motors that turn the auger inside those slushy machines. The -- the designer of that motor was a U.S. based company, but the -- the motors themselves, or at least the components, were sourced overseas.
And in particular, this -- this case involved substitution, so the -- the -- the manufacturer of one of the sub components changed -- substituted a bearing and -- and essentially substituted grease that -- that -- that lubricated the bearing without notifying their client. So these -- these motors failed prematurely.
Q. Okay. All right, moving down to the March 27th, 2012 deposition date, what was at issue in that

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case?
A. I'm sorry, is that the second-to-last?
Q. Yes, sir.
A. That case involved the failure of -- of straps, rigging straps, used to move a piece of machinery.
In this case it was a -- I believe it was a laser cutting machine. It was about a -- a one million dollar piece of equipment that was being off-loaded from a flat bed truck for placement into a -- into a manufacturing building. A strap broke causing the machinery to fall and -- and become damaged.
Q. What were the rigging straps made of?
A. It was a -- it was a polymer material -- nylon.
Q. And were you asked to determine the cause of the failure of the rigging straps?
A. Yes.
Q. And what was your determination?
A. That the straps were cut by -- because they were improperly placed over a -- a sharp edge.
Q. Okay, and looking at the last entry where your deposition date took place on September 3rd, 2010, what was at issue in that case?

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A. That was a water loss in Wisconsin involving a -- a freeze-up of a -- a plumbing system in a house. And when the ice thawed, the -- the water flowed and caused water damage.
Q. Okay. Now, you had mentioned that there were two others that you don't believe are included on this list.
Do you recall what those two cases involved?
A. Yes. The -- one of them was actually a second deposition in the Cass case, of the second from the top on the first page -- the Robert D. Cass and Carol Cass versus Fisher Controls. It was a second deposition in that case.
Q. Do you know why you were deposed a second time?
A. I -- I don't know. I -- the -- the attorney liked depositions I guess. In the second one -- or a second one -- I'm not sure if it's the last one that's -- that's missing here -- was a case that's still active.
It involves an injury at the Minneapolis Airport in which one of these ground power unit cables -- so it's essentially when the -- the airplane pulls up to the gate ---

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Q. --- Yeah.
A. --- The plane is plugged in ---
Q. --- Uh-huh.
A. --- So it gets power from -- from the -- from the ground as opposed to from the engines. And there was a -- a retainer clip that -- that holds this heavy cable up on the gate, it broke and fell and it hit one of the workers in the head, causing injury.
Q. Okay.
A. I -- I don't recall any others at this point.
Q. Based on what we have just gone through, you have not provided expert testimony in any cases dealing with a fiberglass material. Correct?
A. No. But I do have some active cases, though, that involve fiberglass materials but they haven't come to deposition or -- or trial yet.
Q. Okay, how many active cases involve fiberglass materials?
A. Either two or three. There's obviously this one. There's one involving a -- there are gas fueled vehicles out there.
So compressed natural gas vehicles that have -- or even propane -- there -- there are trucks

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on the road, cars on the road -- and the -- instead of having a gas tank, they have pressurized gas cylinders mounted to the -- the vehicle.
And many times those -- those tanks are -- are composite materials, whether it's fiberglass or -- or carbon material. But it's -- it's a -- I -- a fiber-type composite material. And so I have another case right now involving a death in which one of these cylinders burst.
Q. And the gas tank is made of a composite material?
A. Yes. So you know, imagine the -- the propane tank you have on your grill ---
Q. --- Uh-huh.
A. --- But they also make those out of fiber composites. So it -- it's -- it's wound fiber with a, you know, a -- a resin that holds the fibers together.
Q. So the gas tank is fiberglass?
A. Well, it -- it -- it's a fiber composite. So -- so again, fiberglass is -- is one -- one type of -- of material belonging to a larger group of materials of -- of fiber-wound parts that are -- that have a resin matrix.
Q. And have you determined what has caused

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the gas tank to fail?
A. No. No, that's -- it's so early on.
Q. Any others -- strike that.
Any other projects that you're currently working on that involve fiberglass other than the one you just told me about?
A. Well, it -- I have between a hundred and 150 active cases I think. So I -- I -- I can't think of any off-hand right now.
Q. Okay. In the one you just told me about involving the gas tank, you have yet to provide any testimony. Correct?
A. Right. Right. Actually, I -- I do recall a similar case a few years back involving another ruptured cylinder on a -- a CMG fueled vehicle. I don't know if that resulted in death. But it was another fiberglass tank containing compressed natural gas.
Q. And did you determine what -- did the gas tank fail?
A. It did.
Q. Did you determine the cause of the failure of the gas tank?
A. I'm trying to remember the details of that. I -- I believe that one was a result of -- of

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rubbing. So the -- the tank was rubbing against part of the vehicle and it -- I think it -- it rubbed through the wall of the -- of the tank, weakening it.
Q. Did you provide testimony in that case?
A. No, no.
Do you mind if I get another glass of water?
Q. Not at all.
Based on what we have just talked about, you have not provided testimony with regard to a fiberglass pipe. Correct?
A. No, I have not.
Q. Okay. Generally, with the cases that we've looked at that are listed in your CV, do you recall whether you were testifying on behalf of the plaintiff or the defendants?
A. Generally, I -- I have a mixture. I don't know if it's a 50/50 mixture, but it's -- it's -- it's -- I think it approximates an even mixture between plaintiff and defendant.
Q. Okay, so you've been hired by both ---
A. --- Oh ---
Q. --- Plaintiffs and defendants.
A. Certainly.
Q. In the cases in which you testified at

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trial, did the court qualify you as an expert witness?
A. Yes.
Q. Okay, have you ever not been qualified as an expert witness?
A. No.
Q. Mr. Pfaendtner, is there any education, training, or experience that we haven't discussed this morning that you feel like you relied on in formulating your opinions in this case?
A. Yes. So as part of my education in -- in engineering school, I've taken many mechanical engineering classes because you can't study materials in -- in a -- in a vacuum without understanding mechanics of the materials.
So I've had several classes in engineering mechanics, strength of materials, fracture mechanics -- but just understanding the effects of -- of stresses in -- in materials and -- and the -- the result and behavior of those materials to -- to the stresses.
So -- and -- and basically every -- not every -- but -- but many failure analysis involve, again, the combination of the -- the discipline of -- of engineering mechanics with -- with material

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properties and -- and understanding just the -- the intersection of -- of -- of those where failure happens.
So -- so clearly in -- in the -- in the present case, we have a -- a damaged fiberglass pipe. And understanding the -- the nature of that damage -- or what's critical to understanding the nature of that damage is -- is, in essence, the -- the micro mechanics going on in -- in -- in the fiberglass material, understanding what forces are at play to have caused this pattern of deformation.
Q. And you mentioned that you took mechanical engineering classes during your undergraduate work. Correct?
A. Yes.
Q. Have you taken any mechanical engineering courses since that time, whether it be continuing education or some other professional course?
A. No. It was -- part of my PhD was -- was mechanical engineering.
Q. Okay.
A. So several graduate level classes in fracture mechanics, elasticity, continument -- continuum mechanics, finite element method, statics dynamics, things like that. But -- but fundamental

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core mechanical engineering course work.
MS. GAVALIER: I tell you what. Let's take a quick break, just five minutes or so.
THE WITNESS: Sure.
MS. GAVALIER: We'll go off the record.
(11:25-11:33 - recess)
Q. (Ms. Gavalier) All right, Mr. Phaendtner, who retained you to work on this project?
A. Mr. Reich's firm.
Q. Womble Carlyle?
A. Yes.
Q. Have you worked with anyone at Womble Carlyle prior to working on this project?
A. I have not.
Q. Do you recall when Womble Carlyle retained you?
A. In September of 2011.
Q. September of 2011 was just a month after the fuel release. Correct?
A. Yes.
Q. Have you had the opportunity to visit the site of the fuel release?
A. I have not.
Q. Have you spoken with anyone from Amec?

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A. I have not.
Q. All right, Mr. Phaendtner, I'm going to see if we can agree on certain things so that we can lay a foundation for moving forward and exploring your opinions.
A. Okay.
Q. Okay, do you agree with me that there was a fuel release at the Marine Corps. Air Station, New River on August 9th, 2011?
A. Yes.
Q. Do you agree with me that the fuel transfer began around 12:30 p.m.?
A. That's what I understand happened.
Q. Do you agree with me that there was a 12,000 gallon fuel transfer?
A. That's what I read, yes.
Q. Do you agree with me that at one p.m. 3,000 -- excuse me -- 3,000 gallons were reported to have been received?
A. I read that, yes.
Q. And do you agree with me that roughly 9,000 gallons of fuel was released?
A. Yes, that's what I read.
Q. So you would agree with me that in a 30-minute period of time, 9,000 gallons of fuel was

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release.
A. I think that's what the math works out to, yes.
Q. And you would agree with me that the math would work out to 300 gallons of fuel being released per minute.
A. Yes.
Q. And that -- you would agree with me that the math works out that that would be five gallons of fuel released every second.
A. Yes.
Q. And you would agree with me that 9,000 gallons of fuel being released over a 30-minute period of time is a catastrophic release.
A. I have no opinion on that. And I'm not sure what -- I -- I suppose catastrophic can be defined in many ways depending on -- on the nature of -- of what happened. So I -- I have no opinion on that.
Q. You would agree with me, though, that 9,000 gallons of fuel being released in 30 minutes is not a minor release.
A. Again, I think that's more of a -- a -- an OSHA type thing and not -- not something that's in my -- in my wheelhouse.

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Q. You would agree with me that fuel was released as a result of the damaged pipe.
A. Yes, that's the conclusion I've come to.
Q. And you would agree with me that the damaged area of the pipe was near the crossover of the new pipe and the existing pipe.
A. I -- I think within the near grassy area of where the digging was, yes.
Q. And you would agree with me that there's a scrape on the pipe.
A. Yes.
Q. And you would agree with me that the scrape on the pipe is consistent with damage induced by hydraulic equipment.
A. Yes.
Q. And you would agree with me that Talon was operating hydraulic equipment in close proximity to the damaged area of pipe on August 9th, 2011.
A. Yes.
Q. And you would agree with me that Talon excavated in the immediate vicinity of the damaged area of pipe on August 9th, 2011.
A. I guess it can be argued based on the testimony what immediate vicinity -- but certainly within six feet or thereabouts.

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Q. And you would agree with me that the pipe was repaired.
A. That's what I've read, yes.
Q. And you would agree with me that the area was remediated.
A. Yes.
Q. And you would agree with me that costs were incurred in the repair of the pipe and the remediation of the area.
A. I imagine there are costs associated with them, but I don't know what the costs are.
Q. Mr. Phaendtner, in your opinion, did an excavator bucket scrape the pipe?
A. I -- I think that's the most likely cause of the -- of the damage to the pipe, yes.
Q. In your opinion, it just was not the Talon excavator bucket. Correct?
A. That's correct.
Q. Okay. You are not saying that an excavator bucket scraping the pipe is okay. Correct?
A. No, not at all. No.
Q. An excavator bucket scraping a pipe is not okay. Correct?
A. It -- it's an un -- undesirable thing, yes.

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Q. Would an excavator bucket scraping a pipe comply with standards such as industry standards or a standard of care of an excavator?
A. Could you repeat that, please.
Q. Sure.
Would an excavator bucket scraping a pipe comply with standards?
A. Are you asking if -- if that's allowed by any standards? I -- I would be doubtful if any standard said you may strike this pipe with a -- with an excavator bucket.
Q. Standards would likely be in place to prevent an excavator bucket from scraping a pipe. Correct?
A. I -- my -- I haven't seen any standards that specifically mention excavator buckets, whereas I would imagine the language would be more, you know, care should be exercised in -- in working around pipes.
I mean, I -- but -- but -- I don't -- I don't recall any specific language in -- in codes or anything.
Q. Well, in the exercise of care in excavating around a pipe would include not striking the pipe. Correct?

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A. Yes.
Q. Okay. In your opinion, the scrape was created at an earlier time. Correct?
A. Yes, prior to the work done by -- by Talon.
Q. Do you know how long the pipe had existed with the scrape?
A. No.
Q. Could the pipe have existed with the scrape for an extended period of time?
A. Yes.
Q. And what do you base that opinion on?
A. Well, the fiberglass material is generally more inert than say a buried steel pipeline in that it doesn't corrode in the -- in the conventional sense of -- of iron or steel corroding.
The -- its -- its primary degradation might be from ultraviolet light from the sun. This particular pipe was -- was buried so I don't -- it -- it -- it -- it seems unlikely that there were any modes of degradation present for this type of material.
So a -- a scrape like that could exist for very long periods of time without really any -- any observable change other than -- well, other than the

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physical damage being preserved over time without changing.
Q. Do you have any evidence of what created the scrape on the pipe at an earlier time?
A. What evidence created the scrape?
Q. Do you have any evidence of what created the scrape on the pipe?
A. Well, my -- my opinions on that are generally related to the -- the morphology of the -- of the scrape. It's -- it's consistent with a tooth of -- of a -- of an excavator bucket.
I imagine there could be some other tooth-shaped object that was put down there at some point in time, but -- but it seems most logical that it was some kind of digging equipment that had teeth on it.
Q. Do you have any evidence of when the pipe was scraped?
A. No. And -- and -- and I believe that to be unknowable -- unknowable from observation of the -- of the pipe itself.
You know, there -- there might be records buried somewhere on that base that -- that give an indication of something. But -- but in terms of physical evidence, it -- it's -- it's most likely

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unknowable.
Q. In your opinion, is the scrape on the pipe that was caused at an earlier time, is that damage located at the crossover point?
A. I -- I've -- I've read that but I -- I'm not -- I don't know if -- how factual that is, whether it's just simply one of the parties stating that it happened at the crossover point. I'm not sure what that's based on. But I -- I do recall reading discussion of it being at or near the crossover point.
Q. Okay. I'm going to hand you what we'll mark as Exhibit 3.
(* Exhibit 3 was marked *)
Q. And this is your supplemental report on the failure of the New River MCAS-FRP pipe.
A. Yes.
Q. The report is dated April 29th, 2014. Correct?
A. Yes.
Q. And April 29th, 2014 was yesterday. Correct?
A. That's correct.
Q. Okay. Did you finalize your opinions yesterday?

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A. No. I think the -- the -- the bulk of my opinions expressed in my reports were mostly finalized some months ago.
The reason that this report was finalized only yesterday was -- it had to do primarily with the calculations done by -- by Chris Brand, my colleague at Crane Engineering.
Q. So the report that was produced yesterday does contain new information. Correct?
A. It -- certainly it -- there -- there's some new information since my -- my first report. But all the information is fully consistent with my opinions from -- from the first report. I -- I -- I've -- I've found nothing new that would contradict previous opinions.
Q. The report produced yesterday contains an analysis that had not been previously produced. Correct?
A. Certain -- the finite element analysis, yes.
And actually, these last figures here, figure 15 and 16 were produced yesterday morning.
Q. Okay, and, Mr. Pfaendtner, to the extent that there is new information in your report that we received yesterday, we would just like to reserve our

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right to talk to you about that at a later date.
A. Absolutely, yes.
Q. You mentioned that you had a mechanical engineer assist you with this report. Correct?
A. Yes.
Q. And is that Christopher Brand?
A. Yes.
Q. Okay, and Christopher Brand works with Crane Engineering. Correct?
A. Yes.
Q. And how long has Mr. Brand worked with Crane Engineering?
A. It's been on the order of two years.
Q. Prior to joining Crane Engineering, was Mr. Brand a student or was he employed elsewhere?
A. He was employed elsewhere.
Q. Okay. Do you know how long he's been a professional engineer?
A. Certainly I think he's had his license -- he had it at the time he joined Crane Engineering. I'm not sure what year he -- he received his license.
Q. Do you know whether Mr. Brand had been employed as a professional engineer prior to joining Crane Engineering?
A. Well -- well, you don't need to be a

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professional engineer in order to practice engineering. It's -- he worked for another engineering firm prior to that.
And generally, if you work for an engineering company, you don't need an individual license, so I worked at General Electric as a -- an engineer without my license. It was only during my time at GE that I got my PE license.
Q. There's a period of time where you have to train as an engineer prior to getting your license. Correct?
A. Yes. There's a -- a -- an experience component. It -- first you take the -- the fundamentals of engineering test, which you can take immediately after you graduate with your undergraduate engineering degree.
And then there's -- depending on whether you go to graduate school or not there's a -- a several year period of -- of gaining experience before you can sit for the engineering test.
Q. Do you know whether Mr. Brand was completing that experience component in order to obtain his professional engineering license prior to coming to train -- Crane Engineering?
A. I don't know that.

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Q. Okay. I believe you testified Mr. Brand was involved in the finite element modeling. Is that correct?
A. Yes.
Q. Okay, was he involved in any other aspect of the analysis that is described in this report?
A. He was not involved in the physical testing of the pipe that's described in this report.
He mainly reviewed the -- the -- I believe the MDE report and -- and enough material to understand the dimensions of the subject pipe, it's -- the -- the mechanical properties of the subject pipe as inputs into his finite element analysis.
Q. Do you recall when you were asked to perform the final -- finite element modeling?
A. I -- I would say it's in the -- in the last month.
Q. And ---
A. --- As a recommendation -- I'm sorry -- it was my -- my recommendation that it be done.
Q. And why did you recommend that the finite element modeling be done?
A. In part it was in rebuttal to Mr. Manning's opinions.
In particular, the figure nine in his

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report as -- as well as just simply a -- a -- a demonstration of the mechanics of interaction between a -- a bucket and the shape of that bucket with -- with a pipe such as the subject fiberglass pipe.
Q. Okay, and when did you perform the finite element modeling?
A. I -- I believe Mr. Brand's been working on it over the past two weeks or so.
Q. Okay, and what data does Mr. Brand use in order to perform that analysis?
A. I don't know what specific information he used.
But the general inputs into a finite element analysis are -- are things like the dimensions of -- of the components, so the dimensions of the subject pipe. It's a six-inch fiberglass pipe. It has a certain wall thickness. It has certain elastic properties.
And then he -- he models the impingement of, you know -- of -- of a feature meant to replicate a bucket whether it's a tooth or a straight blade, the dimensions of that.
So again, it -- its -- its -- its dimensions and material properties that are -- that are inputs with things that are called boundary

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conditions.
Q. You mentioned that Mr. Brand obtained the dimensions of the subject pipe from the MDE report. Correct?
A. I don't know exactly whether he used my measurements from my inspection or the MDE report. I don't recall there being any conflict between the measurements. But it -- I would say between my measurements, the MDE report measurements, and the -- what was available -- what literature was available on this particular pipe, you know, I'm sure he drew from those sources.
Q. What were his sources for the measurements of the finishing edge and the tooth?
A. The -- the -- the -- the size of the tooth, he -- he took that from the -- the size of the tooth that we used during our physical testing which was about three and a quarter inches.
The -- the size of the finishing edge, I believe he just took some length that -- that extended -- was larger than the -- than the -- the -- the diameter of the pipe.
Q. And the data that Mr. Brand collects is entered into a computer software program. Correct?
A. Right. In finite element you essentially

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paint a picture of the scenario, again, the dimensions and you want the -- the bucket to come down a certain displacement.
And then -- then you let the computer calculate giving your inputs and using physics, you know, what's -- what's the -- the physical response of this material of being pushed on in a certain way. It -- it calculates what the stressors are, what the displacements are after -- after that action.
Q. Would Mr. Brand also have to input data that relates to the force exerted on the pipe or the angle at which that force is being exerted?
A. Those can be inputs. You -- you can -- you can specify a force or a displacement. So the -- the inputs can vary.
So you -- you can apply a displacement and measure a result in force, or apply a force and measure a result in displacement.
Q. Do you know if Mr. Brand entered variables such as the force or the angle or things of that nature?
A. I haven't had specific discussions on -- on those details. But I think studying the outputs of -- I -- I -- I believe the -- the tooth or the bucket was -- the force was applied perpendicular to

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the axis of the pipe. And -- and he did -- he did apply displacement as opposed to a force ---
Q. --- Okay.
A. --- In his calculations. Although, I -- I -- certainly we can produce all that if -- if requested.
Q. Yeah, that would certainly be helpful. And I know we probably need a compatible computer software program. But that would be helpful to go ahead and get that.
A. Right. Well, yeah, there are various levels. But certainly we can supply you on a piece of paper the inputs.
But yeah, you would need a compatible software in order to -- to run the simulation yourself based on what his inputs are, but it's certainly doable.
Q. Okay, that would be very helpful.
Do you know if Mr. Brand was able to account for the restraint on the pipe in the simulation?
A. So you're talking about boundary conditions. I -- I would have to check to see what boundary conditions he used.
Q. So you don't know if he modeled the pipe

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with soil around it.
A. I don't know at this point, no.
Q. So based on the modeling, you concluded that the deformation created by the straight edge is different than the deformation created by the tooth. Correct?
A. The elastic response of the pipe is different for sure.
Q. And what do you mean by elastic response?
A. Well, what -- there -- there's an inherent difficulty in -- in modeling composite materials because they're -- they're an isotropic, which means you have fibers going in certain directions, whereas if it were a metal pipe, you have this -- it's called -- it's called anti -- iso -- anti -- isotropy. It's -- it's isotropic, meaning, you -- you have no directionality in the properties.
So -- so the material loss -- so the -- the equation that -- that governs the -- the behavior of the material, how it stretches and how it deforms is very simple for a metal pipe, but it's extremely complex for something like a -- a fiberglass pipe.
So that said, it becomes very difficult to model damage to the pipe. What is easier is simply to model the elastic response, so simply deforming

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the pipe without -- without actually damaging it. So he -- he was not able to model actually scraping the pipe. He just ---
Q. --- Uh-huh.
A. --- Simply indented the pipe because we don't know what the -- what the constitutive relationship is -- what the equation is that -- that governs the damage to the pipe. 'Cause it's -- it's extremely complex and -- and maybe even undoable from a modeling standpoint. And that's why we did the -- the physical testing.
But again, the finite element was mainly to address Mr. Manning's figure nine, which I think is -- is -- was simply -- simply a -- a thought process or thought exercise on his part where he just drew it by hand and -- and didn't have any modeling involved.
Q. So is it more accurate to say that based on the modeling, it's your conclusion that the elastic response created by the straight edge is different from the elastic response created by the tooth.
A. Yes.
Q. Okay. Are there any other conclusions that you have as a result of the modeling?

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A. Well, it -- it -- it certainly reinforces the opinions that I expressed in my initial report, that in order to get the shearing of the fibers, the cutting of the fibers -- to -- to end up in -- with this well-defined scrape, which is actually a trough in the material -- materials removed by the bucket -- to get the -- the well-defined cutting of the fibers, you need a -- a corner of some -- of some kind to -- to shear the fibers.
And -- and -- and so this -- this simple finite element model gives a -- gives an indication that, yes, those -- those shear forces are going to be acting there whereas -- whereas you don't really see it on the -- with the straight edge.
So it -- it's -- it's -- it essentially reinforces the -- the original opinion that the only way you can cut the fibers is if you have a -- a sharp corner dragging across that surface.
Q. Okay. I would like to ask you some questions about the physical testing that you did.
A. Okay.
Q. Did you happen to film the operation of digging the trench, laying the pipe, backfilling the trench, and compacting the soil?
A. Those were captured in photographs. The